Space Weather Technical Forecast

Issued on Thursday, 27 October 2022 at 01:20 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1/Minor geomagnetic storms throughout. Slight Chance of Minor (R1) Radio Blackouts throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity over the past 24 hours has been Low, with one C-class flare, peaking at C6.7 at 26/1243 UTC, originating from AR3133 in the northeast quadrant. This appears to be to the most active sunspot region on the disc. There are four other sunspot regions on the visible disc. AR3126 is becoming difficult to analyse due to foreshortening but appears to only display an umbra in the trailing spot. AR3130 continues to show some development, with growth in its largest spot on the northern periphery of the region. AR3131 in the northeast has shown little change recently, with a large leader spot remaining the dominant feature. AR3132 in the southwest is a simple unipolar spot. A filament eruption was observed lifting off the northeast limb at 26/1630 UTC, although no CME has been seen in coronal graph imagery. Given its location, unlikely to have any Earth-directed component. No Earth-directed CME's have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind parameters, as observed by DSCOVR at L1, continued to show a declining trend after exiting from a High Speed Stream (HSS) of CH34/-. Solar wind speeds have been at background levels, with a peak of 380km/s. Density was below average, increasing to average or slightly above average by end of the period. Total magnetic field strength was weak, with the north-south component, Bz, mostly weakly positive, with some weakly negative deflections. Phi angle was mostly negative (towards the Sun), switching to a positive (away from Sun) by end of the period. Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2MeV) at GOES-16 was at background or moderate levels. The associated 24-hour integrated fluence was well below the Active (1e8 integrated pfu) threshold, with an upward trend and a level of 3.75e6 integrated pfu observed at 27/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be mainly Low with a chance (30%) of M-class flares.

Solar Wind / Geomagnetic Activity: No Earth-directed coronal mass ejections (CMEs) have been observed. The Earth is expected to experience continued slow ambient solar wind speeds during the first half of day 1 (27th). During the second half of day 1 (27th) or during day 2 (28th) Earth is anticipated to connect with the high speed stream (HSS) from CH36/+. A further enhancement is possible to elevated solar wind speeds on days 3 and 4 (29-30th) due to the arrival of CH37/+. Geomagnetic activity should remain Quiet (Kp 0-2) with isolated Unsettled (Kp 3) intervals early day 1 (27th). Any time from midday day 1 until day 4 (27th-30th) there is an increasing chance of Active or Minor Storm (G1) intervals (Kp 4-5), as the Earth connects with

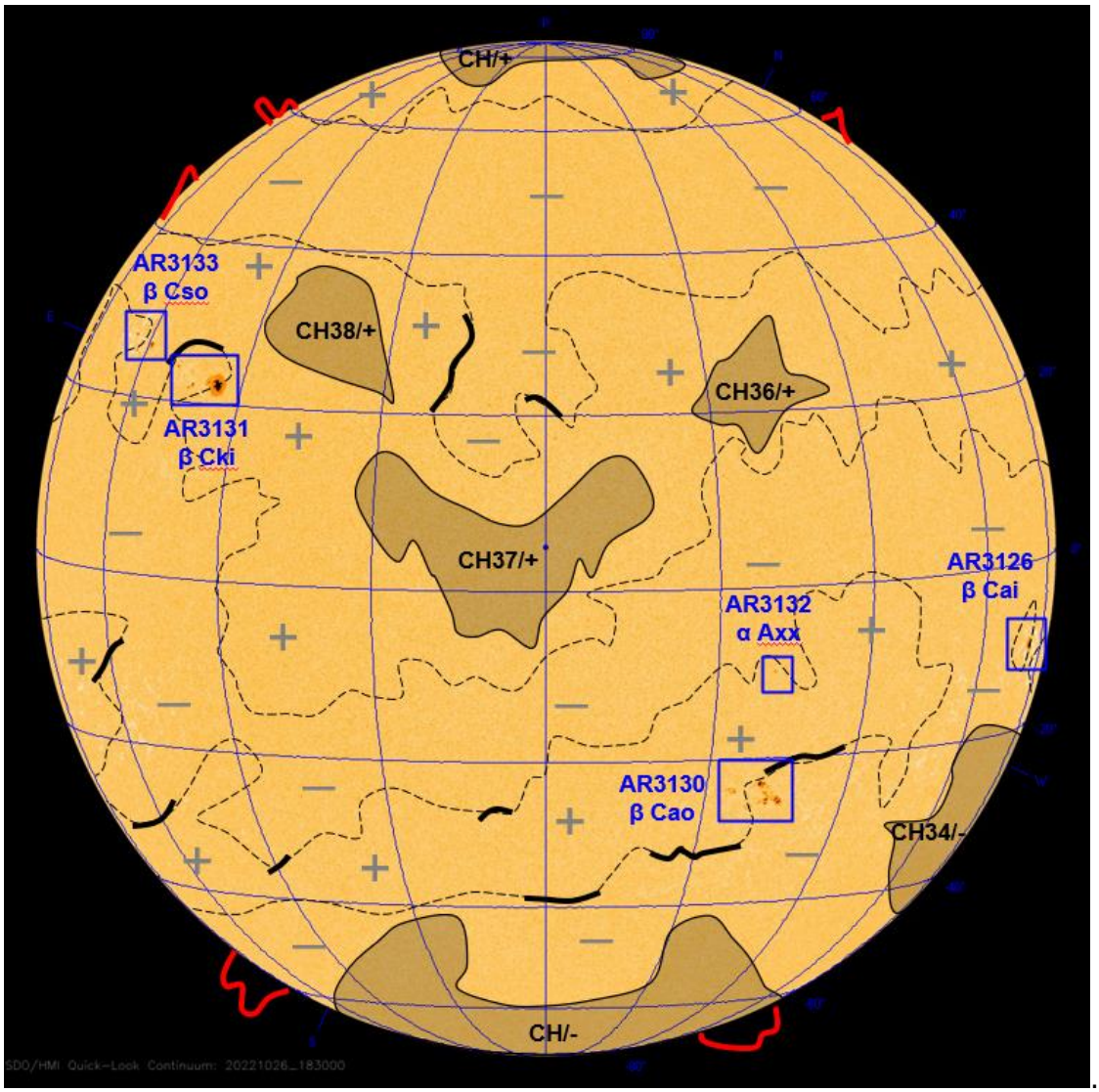
Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

the high speed streams related to CH36/+ and then CH37/+.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) is expected to be at background levels. High energy electron flux (greater than 2MeV) is expected to be mainly background to moderate levels at first, but is expected to trend towards higher levels through the period, with continued slow-ambient wind speeds post connection to CH34/-. Further reductions are possible from late day 1 (27th) onward due to further high speed streams from CH36/+ and Ch37/+ likely compressing the van allen belts. Electron fluence values are forecast to trend upwards, with a slight chance of reaching the Active threshold from day 1 (27th) onward.

Figure 1. Solar Analysis Valid 26/1830 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Geomagnetic Storms:

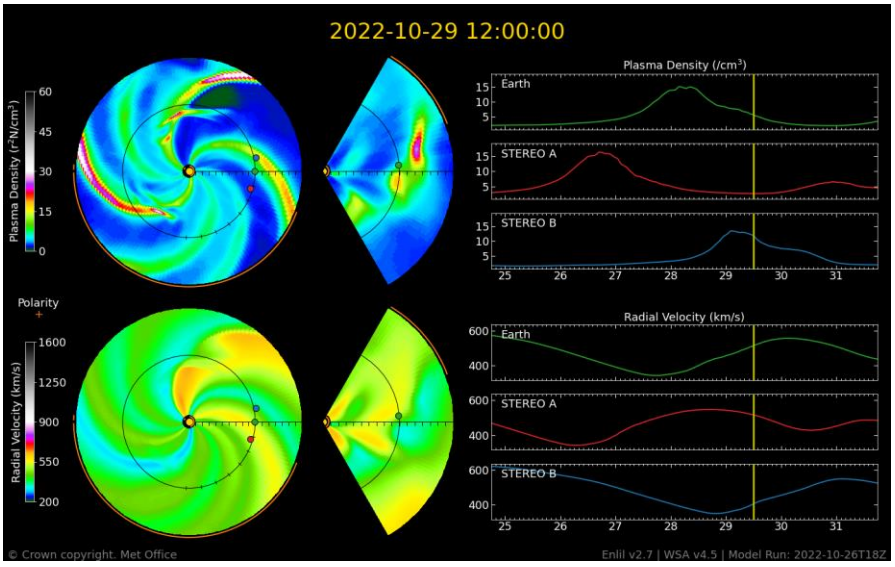
No Earth-directed CMEs have been observed in available imagery.

The Earth will continue to exit the HSS from CH34/- until day 1 (27 Oct), with slow-ambient solar winds declining a little further. An uptick in solar wind levels is forecast either second half of day 1 (27th) or during day 2 (28th) as the Earth connects with the HSS from CH36/+. On the last rotation this feature gave elevated levels, reaching around 500-550 km/s, and current STEREO-A shows similar speeds with an equivalent arrival around midday on the 27th. Another enhancement is expected later in the period from CH37/+, with solar winds reaching similar speeds of around 550km/s, expected to arrive on day 3 (29th).

Geomagnetic activity is expected to be mainly Quiet with isolated Unsettled intervals initially. From the second half of day 1 (27th), there is an increased chance of Active or G1/Minor Storm intervals, as the Earth connects with the HSS of CH36/+ followed by CH37/+ on days 3 and 4 (29-30th). The polarity of these coronal holes is favoured for stronger connections around the September equinox.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	30	40	40
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: MOSWOC Enlil model – shows arrival of CH37 on the 29th, but is missing the arrival of fast wind from CH36 either late on the 27th or during the 28th.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

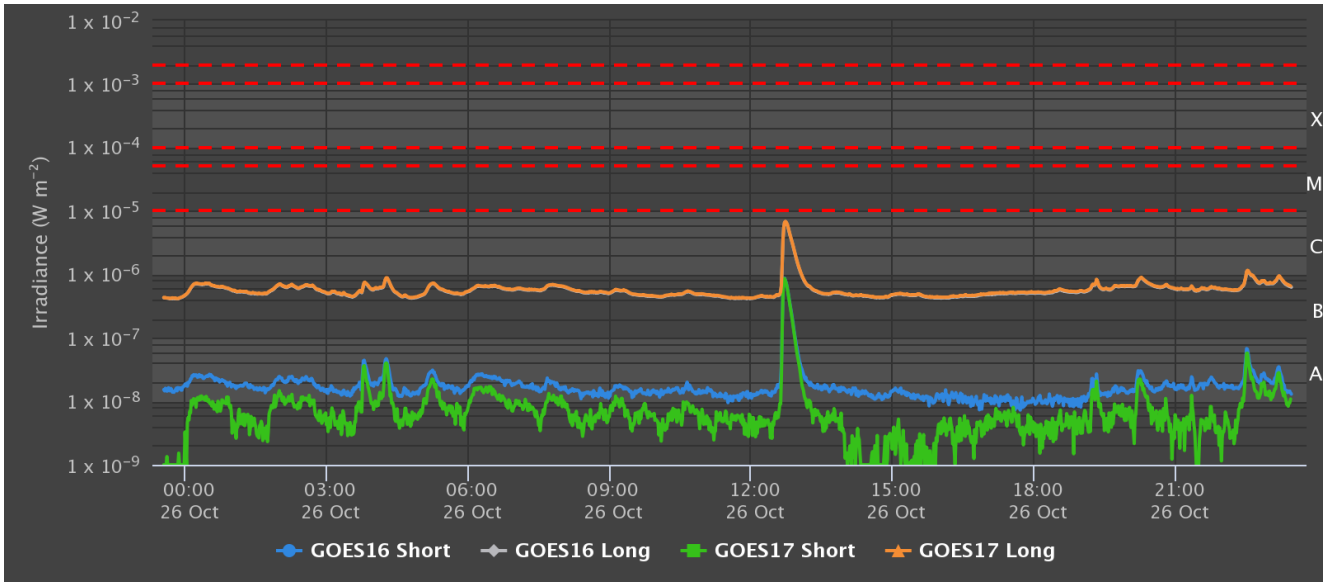
© Crown Copyright 2022. All Rights Reserved.

Radio Blackouts - X-Ray Flares:
Solar activity has been Low with five numbered sunspots on the visible disc. Most of the sunspots are relatively small and benign in activity, with AR3133 in the northeast being the most active region, producing a C6.7 flare at 26/1243 UTC. Despite the appearance of AR3133, it is a returning feature, with further development and enhancement in activity considered a possibility. AR3126 approaching the southwest limb also continues to display some moderate complexity, with a slight chance of moderate flares also possibly emerging from this spot.

Low levels of solar activity with a daily 70% chance for C-class flares and a chance (30%) of isolated M-class flares, mainly from AR3133 and perhaps AR3131 or AR3126.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES-17 X-Ray Flares



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES16 is currently at background and expected to stay at this level with no significant active regions on the visible disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	2	2	2	2
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) has been either background or moderate in the past 24 hours, likely due to the waning influence of CH34/- and the relaxation of the van allen belts from the reducing solar wind speed. Electron flux levels are expected to rise in coming days due to the previous charging of the electron fields from CH34/-, with slight chance of high levels of flux on day 1 (27th) before the next HSS arrives either late day 1 or during day 2 (27th or 28th), likely having a similar suppression effect and compressing the radiation belts for perhaps several days.

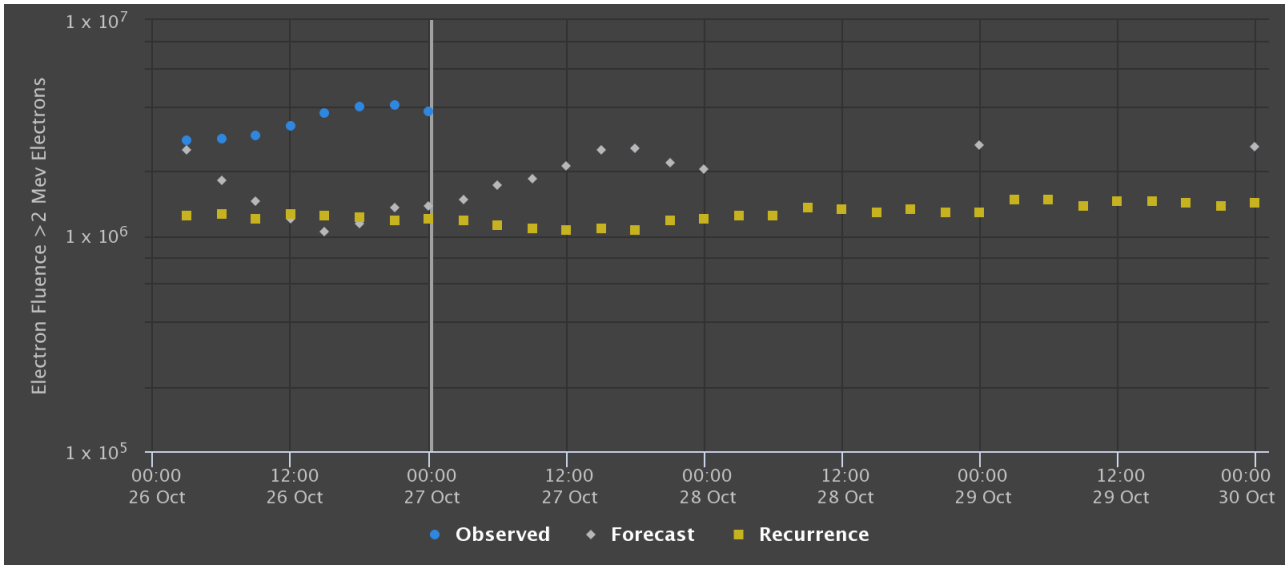
Electron fluence values are expected to continue on an upward trend in line with apparent increasing flux levels, with a slight chance of reaching the Active (1e8 integrated pfu) threshold day 1 (27th).

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	20	10	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Figure 4: REFM Electron Fluence



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.